Space Weather Technical Forecast

Issued on Sunday, 30 October 2022 at 01:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of further G1/Minor Storms days 1 and 2 (30th/31st).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the last 24 hours, with several low energy C-class flares observed. There are four numbered Active Regions on the visible disc. AR3135 continues to develop, with significant symmetrical spots in both positive and negative polarities. AR3131, in the northeast has a large leader spot, but with small, faint, trailer spots. AR3130 on the southwest limb is becoming difficult to analyse but still appears to be a Dai/Beta. AR3133 in the northeast is showing limited evolution, especially in the trailer region. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar winds, observed by DSCOVR at L1, have been elevated mostly between 530-560 km/s but peaking at 613 km/s at 29/0232 UTC. This is due to a connection with the high speed stream from coronal hole 36 and perhaps a concurrent connection with the high speed stream from coronal hole 37. Density was average or just above average, with several peaks of around 16 ppcc. Total interplanetary magnetic field strength was moderate at the start of the period, reaching a peak of 11nT at 29/0013 UTC, but soon declined to weak values, for much of the period below 6 nT. The north-south component, Bz, initially varied between peaks of +/-10nT however it quickly fell to weak values between +/-6 nT, with a bias to negative Bz values. Geomagnetic activity was mainly Active with a G1/Minor Storm period between 29/0600-0900 UTC, before easing to Unsettled from 29/1800 UTC. Phi angle has been predominantly positive (away from the Sun).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at background levels, increasing to moderate from 29/1200 UTC with two very brief peaks into High values, the highest being 1.03e3 at 29/2035 UTC. Fluence levels have been background but rose quite sharply from 29/1200 UTC reaching 2.46e7 integrated pfu at 29/2359 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, with a slight chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Earth is currently under the influence of a high speed stream from possibly a combination to coronal hole 36 and 37. A further high speed stream from coronal hole 38 is then likely to connect with Earth later in the period. Speeds of 500-600 km/s are expected but with a declining trend. Geomagnetic activity is expected to be mainly Unsettled to Active, with a chance of further G1/Minor storms on days 1 and 2 (30th/31st), then mainly Quiet to Unsettled, with a declining risk of Active or G1/Minor Storm intervals through the remainder of the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at background to moderate levels, perhaps peaking at high levels during the diurnal maximum on days 1 and 2 (30th/31st), likely rising on day 3 and 4 (1st/2nd November) as solar wind pressure decreases. The associated 24 hour electron fluence is expected to continue to increase, exceeding the Active (1e8 integrated pfu) threshold on day 3 and 4 (1st/2nd Nov).

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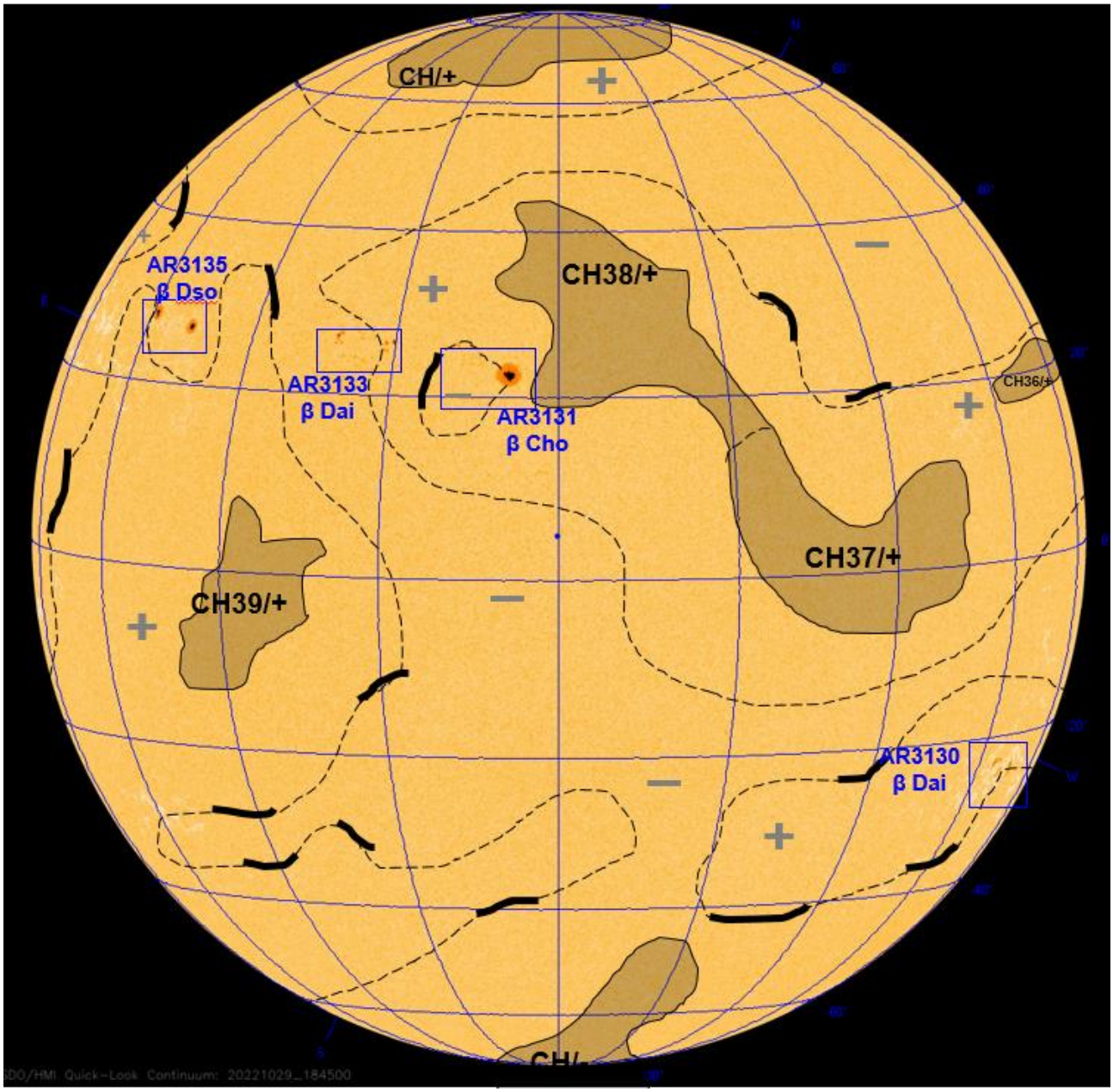
Figure 1. Solar Analysis Valid 29/1900 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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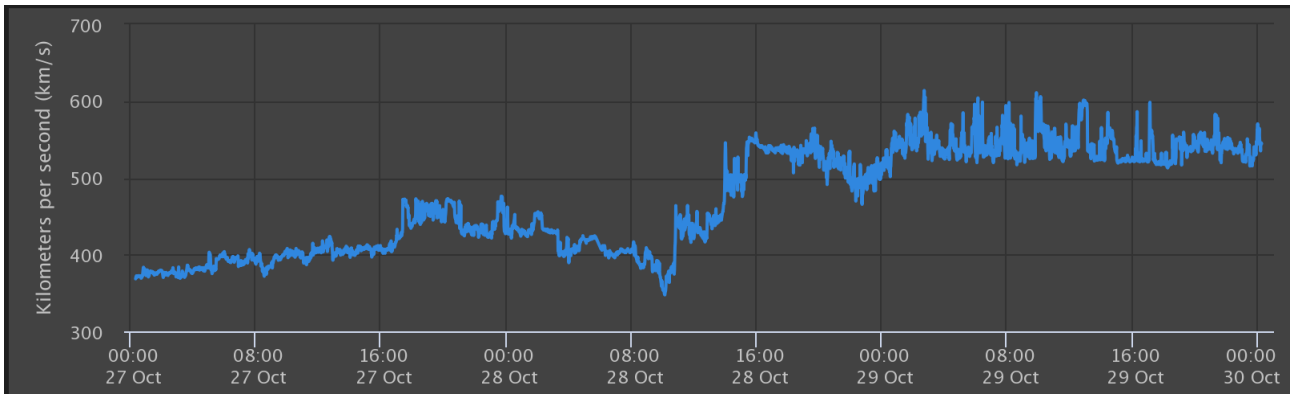
Geomagnetic Storms:

No Earth-directed CMEs are forecast.
The Earth is currently under the influence of the high speed stream from positive coronal holes 36 and 37, with speeds of 500-600 km/s observed. These holes are followed in the northern hemisphere by coronal hole 38. Based on observations from the last rotation where speeds of around 500 km/s were observed, and as these are all recurrent holes and appear stronger on this rotation, speeds of 500-600 km/s are forecast throughout the forecast period. However using recurrence as a guide, the peak speeds are likely to decline towards the end of the period. Geomagnetic activity is expected to be mainly Unsettled to Active on days 1 and 2 (30th/31st), with a chance of G1/Minor Storms. Quiet to Unsettled conditions are then forecast for the remainder of the period, but with a slight chance of further storming when elevated winds combine with sustained periods of negative Bz.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	25	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: Solar wind speed measured by DSCOVR at L1. A CH HSS is now well established.



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Radio Blackouts - X-Ray Flares:

There are four numbered Active Regions on the visible disc. AR3135 continues to develop, with significant symmetrical spots in both positive and negative polarities. AR3131, in the northeast has a large leader spot, but with small, faint, trailer spots. AR3130 on the southwest limb is becoming difficult to analyse but still appears to be a Dai/Beta. AR3133 in the northeast is showing limited evolution, especially in the trailer region.
A number of regions are forecast to rotate onto the disc across the eastern limb through the forecast period, which could further increase risk values.

Solar activity is expected to be mainly Low, with a slight chance of Moderate activity, mainly concentrated in the developing regions in the northeast quadrant.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is currently at background and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at background to moderate levels, perhaps peaking at high levels during the diurnal maximum on days 1 and 2 (30th/31st), likely rising on day 3 and 4 (1st/2nd November) as solar wind pressure decreases. The associated 24 hour electron fluence is expected to continue to increase, exceeding the Active (1e8 integrated pfu) threshold by day 3 (1st Nov).

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	20	40	60	60
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: GOES16 ElectronFlux has increased from 29/1200UTC

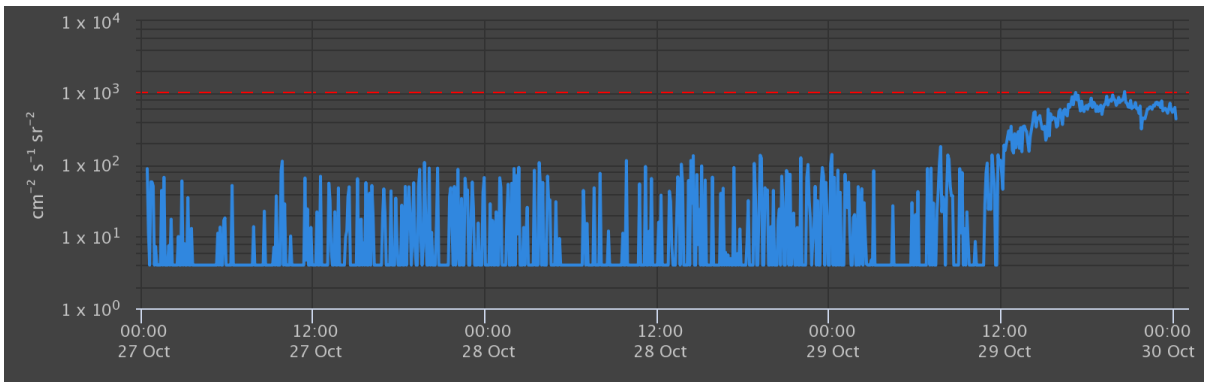
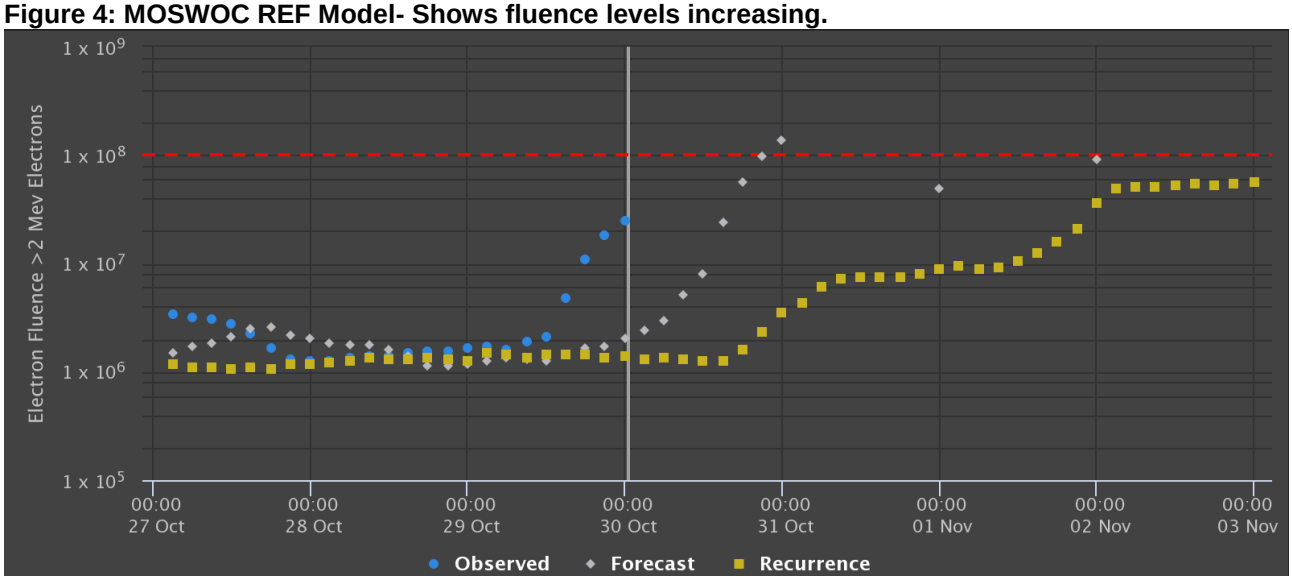


Figure 4: MOSWOC REF Model- Shows fluence levels increasing.



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